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ABSTRACT

A complete analysis of a story's structure must rely on more than a simple grammar of story components: it requires a consideration of the characters' plans as they are stated or implied in the story. Furthermore, these plans are recognized as the characters' beliefs, and beliefs about interactions among plans are crucial determinants of a story's structure. A notation system representing such interacting plans may be applied to a simple children's tale about a fox and a rooster, describing various phenomena that appear in this story. For example, a character in conflict with another may try to conceal his or her real plans or try to deceive the other character into acting in a way that serves his or her own interest at the other's expense. A character may thus construct a plan that is intended to be believed by the other, but is not actually carried out. Such a virtual plan plays a central role in the fox and rooster story and is common in other stories in which characters interact. (Author/AEA)

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Technical Report No. 130

ANALYSIS OF INTERACTING PLANS AS A GUIDE TO THE UNDERSTANDING OF STORY STRUCTURE

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Abstract

A complete analysis of a story's structure must rely on more than a simple grammar of story components; it requires a consideration of the characters' plans as they are stated or implied in the story. Furthermore, it must be recognized that these plans are characters' beliefs, and that beliefs about interactions among plans are crucial determinants of a story's structure. A notation system for representing interacting plans is presented here and applied to a simple children's tale about a fox and a rooster. Various phenomena that appear in this story are described. For example, a character in conflict with another may try to conceal his or her real plans or try to deceive the other character into acting in a way that serves his or her own interest at the other's expense. A character may thus construct a plan that is intended to be believed by the other, but is not actually carried out. Such a virtual plan plays a central role in the fox and rooster story and is common in other stories in which characters interact.

Telling a story may be the most powerful way to communicate an idea. An artful recounting of events not only reveals much about the people involved, but also triggers generalizations that reach far beyond the story itself. It is not surprising then that numerous theories have arisen to explain the structure of stories and how people understand them.

This paper is concerned with the processes of story comprehension, in particular, with the use of structured knowledge in building an interpretation of a story. Since the approach taken here differs significantly from what has traditionally fallen under the label "analysis of the structure of narratives" it may be useful to show how it fits into a scheme of ways to study narratives.

The most popular approach to analysis of narrative structure in current psychology research literature is the story grammar approach. Using this approach researchers observe that the setting of a story is usually in the beginning, that episodes within the story themselves have internal structure, and so on. This is exemplified by (among many others) Propp (1958) in his analysis of Russian folk tales, and more recently by the work of cognitive psychologists such as Rumelhart (1975), Mandler and Johnson (1977), Sutton-Smith, Botvin, and Mahoney (1976), Stein and Glenn (1978), and Thorndyke (1977). Glossing over, for the moment, important differences in structural

analyses of this sort, we can say that they do capture important regularities in story structure. For example, they can be used to describe differences in the folk tales of different cultures, or to describe developmental levels of story understanding.

What a story grammar approach fails to capture is the fact that episodic structure is typically produced by interactions among characters attempting to achieve goals. Any purely syntactic approach, which ignores the effect of characters in the story as active agents, will necessarily be incomplete in its account of the story's structure. Specifically, it will miss the underlying connections among syntactic units of the story.

We are thus led to a second approach to the analysis of story structure, one which analyzes characters' goals and plans. Since we can never know what is in a character's mind, we must infer plans on the basis of the character's actions, statements, and whatever insight the author allows us into his or her mind. Research on plans in stories (e.g., Wilensky, 1978; Schank & Abelson, 1977; Bruce, 1975, in press) has moved towards elaboration of the knowledge about plans and goals that a character could be presumed to have in a given situation. This study may lead to a partial explanation for the types of structures that emerge from a story grammar.

An analysis of characters' plans and goals is itself incomplete unless it incorporates an analysis of the social situation in which these plans arise. We cannot assume that a character acts out of the context of other characters' actions. Their actions may help or hinder or even be the target of the first character. A character must plan and act with the understanding that the other characters are also purposeful creatures whose plans will likely interact with his or her own. Recognition of the interdependencies among plans leads us as analyzers of story structure to posit notions such as social episode to represent the interactions among plans, e.g., cooperation and conflict.

But we must go still further. No one has direct access to the true plan of another but can only hypothesize on the basis of the other's actions. In order to plan, each character must form a model of the plans of the other characters. We must have a way to represent characters' beliefs about each others' plans and to show how their beliefs affect their plans.

Finally, any character can realize that other characters are not only active planners, but also active interpreters of the interactive situation. He or she can then perform actions to influence or discover the beliefs of others. What a character believes that another believes can be crucial to the structure of a story. Since beliefs can be about beliefs, we

can have nested or recursive propositions such as A believes that B believes that A believes P (see Cohen, 1978). This makes possible things such as virtual plans, e.g., a plan that P intends for Q to believe that P has, but that P does not intend to carry out.

The facts that plans of characters in stories are interdependent, that actions are based on beliefs, and that beliefs are recursive lead to our third approach. The analysis of interacting or social plans (as in Bruce & Newman, 1978) thus becomes necessary for the complete analysis of story structure. This paper discusses such an approach and applies it in the analysis of a simple children's story.

The first section below gives a brief overview of the basic concepts and the notation system to be used. It also introduces the problem of embedding: how are beliefs about plans and other beliefs used in forming new plans? This leads into a discussion of different belief spaces and deception among characters. The subsequent section is an application of an interacting plans analysis to a portion of a simple children's story. Following that is a discussion of the role of differences in beliefs and expectations in the perception of interacting plans. In particular, the notion of a critical belief is introduced to account for major differences among readers in their understanding of a story. The next section discusses

limitations of this approach. The final section concludes by suggesting some relations between story understanding and story analysis.

Basic Concepts(1)

The representation of interacting plans involves the use of a set of symbols within a space, known as a belief space, that represents one character's model of the interactive situation. The plans that are represented are those of the target character and those that the target character believes that the other character is carrying out or intending to carry out. Separate models are required in the analysis to represent the points of view of other characters. Within one character's model of the situation there may be a mutual belief space. Any fact falling within this space is believed by the target character to be shared with the other character.

Figure 1 shows a schematic belief space organization for one character's point of view in the story to be discussed in detail in the next section. The areas of the diagram represent different belief spaces for that character. For example, the area "rooster's real plan" contains beliefs of the rooster that

(1) The discussion to follow assumes a two character narrative; the notation can be generalized for more characters. A full catalogue of the elements and other details of the notation system can be found in Bruce and Newman (1978).

he believes are not known to the other character (the fox). The area labelled "fox's real plan" contains beliefs of the rooster about the fox's beliefs. The shaded area in the middle contains beliefs that the rooster believes are shared, or mutually believed.

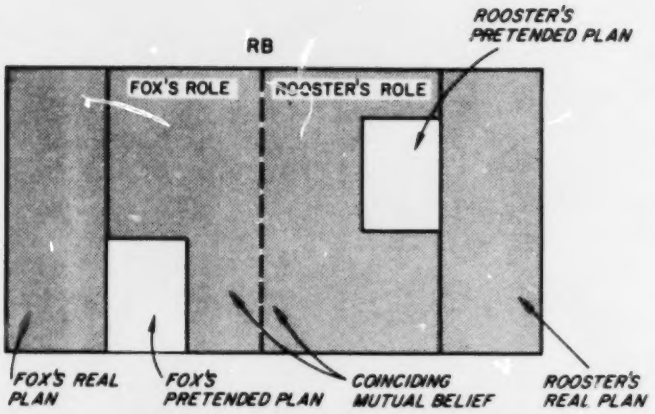

Fig. 1. Belief spaces of the rooster, showing that the rooster needs to separate his beliefs, the fox's beliefs, and their shared beliefs.

An important type of mutual belief space is the social episode. It represents a social activity in which both participants have chosen to maintain a role. A character's role includes the actions that the particular character (say, P) expects to perform, and which P believes that the other character expects P to perform. The role also includes the

intentions that the other character could reasonably infer from P's actions given the assumption that they are cooperating. In the representation of a story in which there are no conflicting plans, a character's model of the situation can be represented entirely within such a mutual belief space. When conflicting goals and deception are perceived by the character, his or her model of the situation will show beliefs outside of the mutual belief space.

Returning to Figure 1, we can see that the central area is a mutual belief space. In fact, it is also a social episode space; it contains beliefs of the participants that they are engaged in a social interaction with prescribed roles. Notice that the area is divided by a dashed line separating the roles of the two characters. If there were no deception in the story, then the social episode from the rooster's point of view would coincide with the social episode from the fox's point of view. We could then speak of their coinciding mutual beliefs and discuss the story without reference to their respective private beliefs. In fact, even where deception is involved, there are usually many coinciding mutual beliefs, e.g., that both parties are physically present, that certain utterances have been made, that certain physical states hold. In Figure 1, such truly shared beliefs are contained in the area of coinciding mutual beliefs. Most of the subsequent discussion, however, will focus

on non-coinciding beliefs, i.e., beliefs that comprise the real and pretended plans of the characters.

The description of interacting plans ultimately rests upon two basic types of entities, states, represented by ovals, and acts, represented by rectangles (see Figure 2 for examples). Acts and states can be either simple or complex (internally structured). While simple states and acts are represented as primitive in a particular diagram, there is no assumption of an absolute, primitive level. Instead, we choose a level of representation appropriate for the context of a given plan. Complex states are represented by an embedding of a state oval in a larger oval indicating: that a character believes (B) that the state holds, that a character intends to maintain (M) the state, or that a character intends to achieve (A) the state. The embedded state may be a complex state; thus we might have a state representing P's intention to achieve the state of Q's intending to maintain some state (see example in Figure 2). Complex acts are formed from simple (or complex) acts in patterns of various sorts, such as enabling chains, i.e., each act in the chain enables the doing of the subsequent act.

Tags are used to mark the temporal, or the real-hypothetical status of the states and acts. For example, in a subsequent figure temporal tags are used to order the acts in an episode. There can also be various relations among

states and acts (shown as labelled arrows). Some important relations are shown in Figure 2: "Specifies" indicates that a general intention generates a more specific intention; "By Means Of" indicates that an intention is carried out by an act; "Produces" indicates that a state (or states) causes another state; and "Has Effect" indicates that an act has a given state as its outcome.

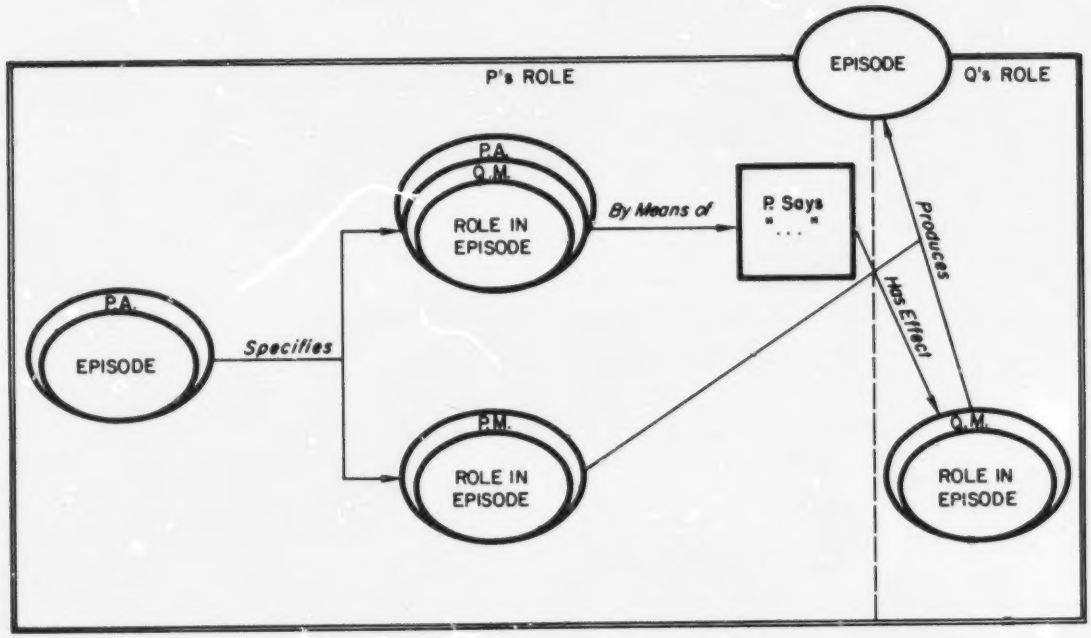

Fig 2. Initiation of a social episode. P and Q are the two participants in the social episode. The embedded ovals represent intentions to achieve (A) or to maintain (M) some state, including, possibly, some other intention. The square box represents the utterance P uses to initiate the episode.

It should be emphasized that acts, states, tags, and relations are the target character's conception of aspects of the environment. This requirement lays the foundation for different levels of characterization of the same event. People respond to their conception of another's actions. Mismatched conceptions may lead to conflicts, or may be the result of deception.

One of the findings of our interacting plans analysis is a set of configurations built out of the states, acts, and relations. Each configuration is a generalization taken from analyses of social interactions in stories or recorded dialogues. To illustrate, one important configuration is the initiation of a social episode, as shown in Figure 2. The episode is labelled in the state node at the top. The intentions and actions which constitute the roles of the two characters (P and Q) are differentiated by a dashed line dividing the mutual belief space. A social episode can be said to commence when the two (or more) participants each have the intention to maintain the episode. Typically, an episode is initiated by means of a speech act, e.g., P says, "Let's do ...." When successful, the initiation produces an intention in the hearer, in this case, Q, to maintain the episode. Q's intention, plus P's corresponding intention, establishes the existence of the episode. This in turn implies a new belief

space, namely, a set of beliefs shared between the participants. One of these beliefs is that the initiation act is precisely that: an act to create the mutual belief space in which it resides.

Given the elements for representing basic plans, i.e., states, acts, tags, and relations, plus the catalog of configurations, plus the facility for representing multiple embedded belief spaces, we can begin to describe the more involved aspects of interacting plans. One of these higher level constructs is the virtual plan. This is a plan that one character (say, P) constructs and attempts to get another character (Q) to believe. It is indistinguishable from a real plan except that P intends for Q to believe the plan while P does not believe it. In most cases, parts of the virtual plan are identical with parts of a real plan; P really intends to carry them out, but the plan as a whole, or critical parts of it, are not real. Virtual plans thus lay the foundation for deception, a surprisingly common aspect of stories in which characters interact. Double deception occurs when a character pretends to be deceived; parallel deception when each character addresses a virtual plan to the other, as in O'Henry's "The Gift of the Magi."

An Interacting Plans Analysis

The Story

The principal features of the interacting plans approach can be seen in the analysis of a simple children's story, here, the story of a fox and a rooster (adapted from Firman & Maltby, 1918):

THE FOX AND THE ROOSTER

1. Once a dog and a rooster went into the woods.
2. Soon it grew dark.
3. The rooster said, "Let us stay here all night. I will sleep in this tree-top. You can sleep in the hollow trunk."
4. "Very well," said the dog.
5. So the dog and the rooster went to sleep.
6. In the morning the rooster began to crow, "Cock-a-doodle-do! Cock-a-doodle-do!"
7. Mr. Fox heard him crow.
8. He said, "That is a rooster crowing. He must be lost in the woods. I will eat him for my breakfast."
9. Soon Mr. Fox saw the rooster in the tree-top.
10. He said to himself, "Ha! ha! Ha! ha! What a fine breakfast I shall have! I must make him come down from the tree. Ha! ha! Ha! ha!"
11. So he said to the rooster, "What a fine rooster you are! How well you sing! Will you come to my house for breakfast?"
12. The rooster said, "Yes, thank you, I will come, if my friend may come, too."
13. "Oh yes," said the fox. "I will ask your friend. Where is he?"
14. The rooster said, "My friend is in this hollow tree. He is asleep. You must wake him"
15. Mr. Fox said to himself, "Ha! ha! I shall have two roosters for my breakfast!"
16. So he put his head into the hollow tree.
17. Then he said, "Will you come to my house for breakfast?"
18. Out jumped the dog and caught Mr. Fox by the nose.

We will examine the portion of the story (lines 8 through 15) wherein the fox attempts to lure the rooster down from the tree. There are three levels to the analysis. First, there is the surface interaction -- two characters arranging a social engagement. Second, there is the fox's real plan, in which he makes use of familiar social conventions to attain his ulterior goals. Third, there is the rooster's real plan, a double deception, which plays upon both the conventional plan and the fox's poorly hidden plan. In the process of considering these different levels of plans (and beliefs about plans) we need to observe the structure of the plans, but more importantly, how the various plans interact.

The Surface Interaction

In nearly every interesting story there are interactions among characters occurring at multiple levels. An analysis of story structure should reflect the different levels of interaction, partly because each level may be important by itself to an understanding of the story, but also because characters can use shared understandings at one level to achieve goals at a deeper level.

In our example story, the fox uses a shared understanding about the social conventions surrounding the breakfast invitation to mask his real plan to devour the rooster.

Similarly, the rooster relies on these shared beliefs to mask his real plan (to stay alive) and to pretend to be deceived. Thus, while the surface level interaction "having breakfast together" is a goal of neither the fox nor the rooster, we need to understand what each of the protagonists believes about the interaction in order to see the form of their real plans.

The surface level interaction is important in another sense. In order for a character to carry out one plan while appearing to do another, he or she must ensure that the virtual plan mimics ordinary social reality as closely as possible. Our study of a virtual plan thus becomes a study of the forms of ordinary social interaction. Most of the comments on the form of a virtual plan will necessarily extend to general social interaction.

In "The Fox and the Rooster," much of the interaction is built around the "breakfast" episode. As mentioned above, this episode is never accomplished and never intended to be accomplished by either participant, but if it were carried out, it would have the form as shown in Figure 3. On the left side are the fox's actions: inviting, going home, and having breakfast. On the right side are the rooster's: accepting the invitation, leaving the tree, going to the fox's house, and then also eating breakfast. The empty slot indicates that the role of the rooster could have been filled by any character; that is,

the fox is initiating what should be a familiar pattern of social interaction, inviting someone to share a meal. Invoking this plan simplifies the fox's interaction with the rooster. He needs only to say, "Will you come to my house for breakfast?", in order to call up in the rooster (and thus communicate) the appropriate sequence of actions, beliefs, and role characteristics for the complex activity of sharing breakfast.

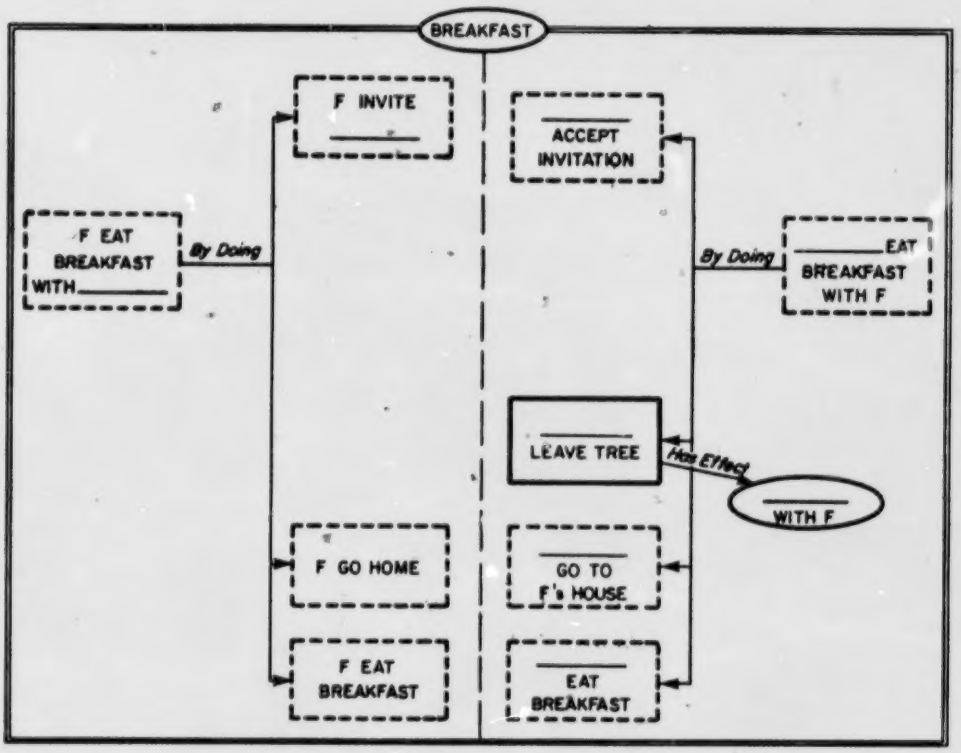

Fig. 3. The ordinary breakfast plan. Each box represents an act to be performed by either the fox (F) or the guest.

That the fox's plan is succeeding (in his view of the world) is partly confirmed when the rooster says, "Yes, thank you, I will come, if my friend may come, too." This shows first, that the rooster is responding in an episode appropriate way, and second, that he is suggesting a modification to the episode that is compatible with its detailed structure. In Figure 4, we can see that the rooster has, by his utterance, put himself in the "someone" slot and then altered the episode to include his friend. The episode shown in Figure 4 is simply an elaboration of that shown in Figure 3. The rooster does not appear to disturb the fox's basic plan. In particular, he does not disturb the outcome desired by the fox, i.e., "R with F" (or rooster with fox).

In the figure, all the boxes except one are dashed, indicating that those acts are not intended to be executed. The one box labeled "_____ leave tree" and the oval labeled "_____ with F" are solid, indicating that the act of leaving the tree in order to be with the fox is part of the fox's real plan. In fact, this act is part of both his real plan and his virtual plan. The virtual plan is constructed around it to make it appear less dangerous than it really is.

Figures 3 and 4 show only the actions to be performed by the participants in the breakfast episode. They do not show either their intentions or the changing state of the world while

they are doing these actions. This pictorial simplification was done to highlight the sequence of (virtual) actions. In subsequent diagrams we will need to look more closely at the specific intentions of the fox, and then the rooster, for the story moves, not by the virtual actions, nor even by the real actions alone, but by the conflicting intentions of the characters.

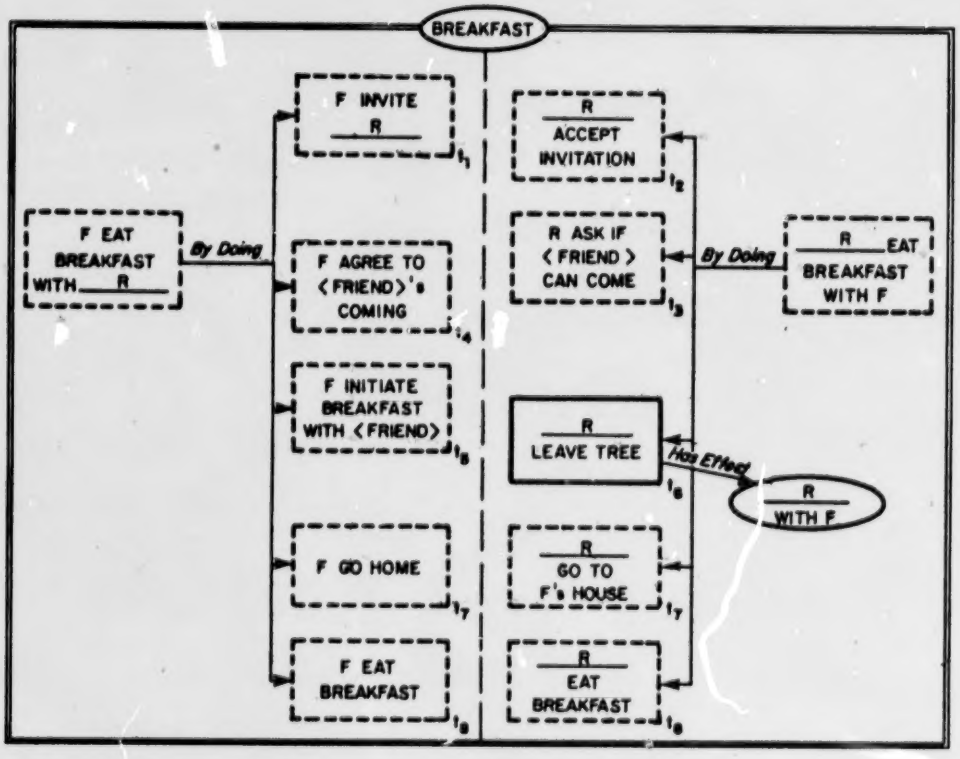

Fig. 4. The breakfast plan as modified by the rooster. The subscripts mark the temporal order for the acts. In the fox's real plan only acts t1 through t6 are expected to be done; in the rooster's real plan only acts t1 through t5 are expected.

The Fox's Plan: Deception

The fox wants to have a breakfast, not with the rooster, but of the rooster. As one ten year old explained, "He's going to be the breakfast!" How does the fox get the rooster to cooperate and come down from the tree? His plan is simple: make the rooster believe that the fox is friendly and that it is all right to engage in an ordinary social interaction with him. The ordinary social interaction plan will be virtual, since the fox never intends to carry it out; his real plan is to eat the rooster.

Since the fox is being deceptive, he has both real and virtual intentions. A diagram of his beliefs shows two complete plans, one real and one virtual, such that the real plan can be overlaid on the virtual plan, matching at crucial points. Figure 5 is a simplified sketch of such an overlay. Intentions shown in the figure are in solid lines if they are part of the real plan, and in dashed lines if they are only in the virtual plan.

In the figure, higher or more general intentions are on the left, specifying other intentions as one scans to the right. The "Specifies" relation holds between the general and the more specific intentions. The dashed vertical line separates the fox's role in the episode from the rooster's. Thus the states, "rooster believes fox is friendly," and "rooster intends to

maintain role in episode" are shown to the right of the line. Each of the other embedded ovals represents an intention of the fox.

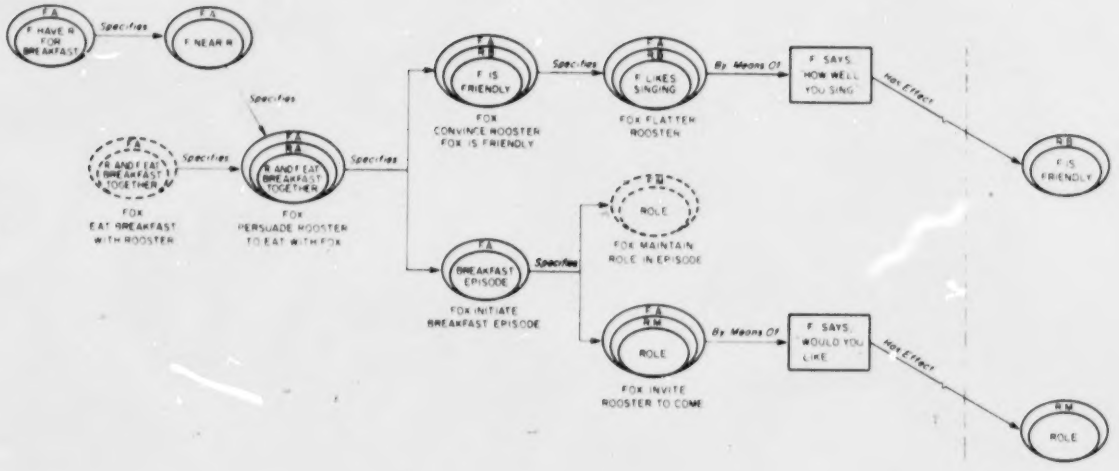

Fig. 5. The Fox's real plan. This is an overlay of the fox's real plan (in solid lines) and his virtual plan (in dashed lines). The embedded ovals represent intentions to achieve (A) a state, intentions to maintain (M) a state, or beliefs (B). The vertical dashed line separates the fox's (F) role in the episode from the rooster's (R).

Reading from left to right, we see that the fox's intention to have the rooster for breakfast can be achieved if the rooster is near. This specifies an intention to have the rooster near, which, in turn, specifies another intention, to get the rooster to want to eat with the fox. This intention to create an

intention conveniently happens to be one which is specified by the highest level virtual intention (shown in dashed lines at the far left), namely, that the fox and rooster will eat together.

The coincidence of the real and the virtual plans means that henceforth most of the more specific intentions can serve a dual role; i.e., by furthering the virtual plan they automatically further the real plan. For example, it is appropriate to both the (virtual) breakfast plan and to the (real) eating-rooster plan to invoke a strategy of the following form (cf. Figure 5):

A PERSUASION STRATEGY

If you want to get person P to do A, then

(1) convince P that you are friendly, and

(2) either

(a) ask P to do A, or

(b) ask P to do B, where A is a sub-plan of B

For the virtual plan, the act, A, is "eat breakfast with fox." For the real plan, A is "leave tree" and B is "eat breakfast with fox" (as in Figures 3 and 4). To fulfill the virtual plan, the fox needs to convince the rooster that he is friendly. Since his real plan depends upon fulfillment of the virtual

plan, convincing the rooster that he is friendly also helps to fulfill the real plan. Note however, that one intention for the fox, namely, maintaining his role in the episode, must remain simply virtual and not serve a dual role.

The fox's plan is thus a two level interacting plan. At one level he appears to be carrying out the ordinary interaction of inviting someone to breakfast. At a deeper level, he is using the same actions to fulfill his real goal of eating the rooster. These two levels can be explained as existing simultaneously, but in different belief spaces. The breakfast episode, i.e., the ordinary interaction which has a virtual status, is in a mutual belief space. The fox believes that the rooster believes that the episode is legitimate and fully shared. The fox's real plan is, however, (so he believes) known only to himself.

The Rooster's Plan: Double Deception

The rooster does not want to be breakfast. In fact, he probably does not even want to have breakfast with the fox. On the other hand, we may assume that the rooster foresees that a simple refusal on his part will simply force the fox to try another plan. To get rid of the fox permanently the rooster must pretend to be fooled.

Figure 6 shows the rooster's real plan. It is simple in terms of the number of intentions, but quite complex in terms of its embedded structure. In this case, the highest level intentions are on the right and we read from right to left. One might imagine a giant diagram incorporating Figures 3-6 in which the fox's intentions come from the left side of the page towards the middle and the rooster's come from the right towards the middle. Across the dashed line separating their plans we can see the evidence of conflict. In fact there need to be two such diagrams, one for the rooster's point of view and one for the fox's. In this section we focus on the rooster's plan as he knows it.

The rooster, in order to get rid of the fox, must get the fox to modify his plan. But the modification cannot be in terms of the fox's real plan, because the rooster is not supposed to know about that (although he clearly does). Thus the rooster must make the fox modify the surface (virtual) plan in such a way that the real plan will be foiled, all without the fox's suspecting.

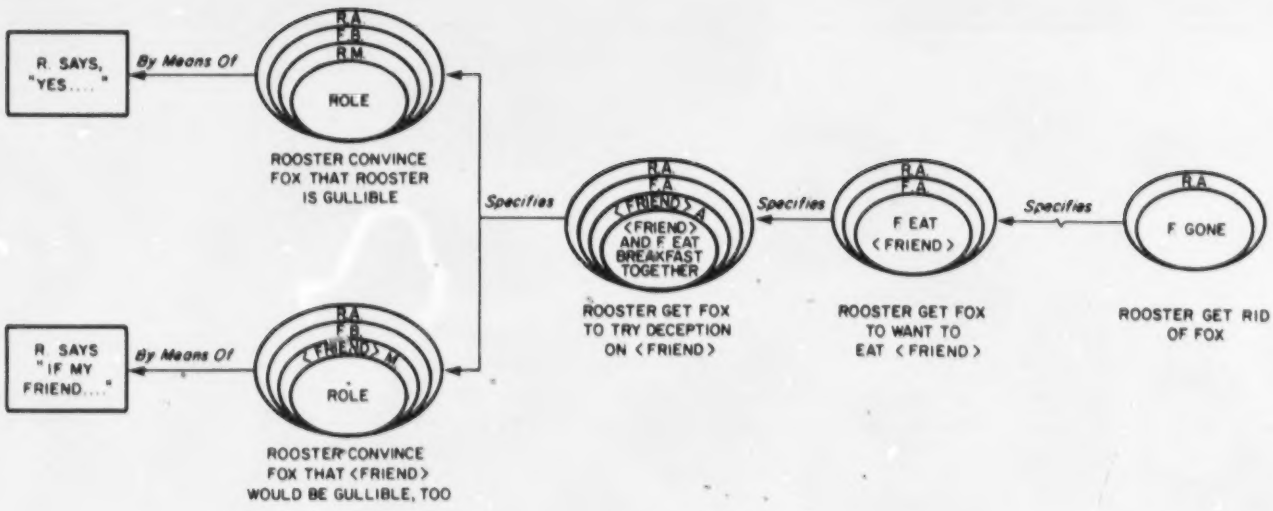

Fig. 6. The rooster's real plan. The rooster (R) is attempting a complex deception on the fox (F), which relies on a difference in beliefs about the identity of <FRIEND>.

The rooster develops his plan through the involvement of a third character, the dog, but for our purposes here we can consider the dog to be outside of the interactive situation. In fact, one can assume that the dog knows nothing and bites the fox solely in response to being awakened. To get the dog involved, the rooster needs to get the fox to see an advantage for himself in including the dog. Because the rooster presumably believes that foxes know that dogs are their enemies, he cannot even suggest that the dog is present. Instead, he

refers to the dog as his "friend," allowing the fox to believe that the friend is another rooster. The fox can then fall into the trap of greed, believing that the plan that is apparently working on rooster number one will work as well on rooster number two.

In Figure 6, we see that the rooster's intentions are actually intentions to create intentions in the fox, e.g., get the fox to want to eat "friend," then get the fox to want to try the breakfast plan on "friend." Conveniently for the rooster, he can suggest modifications in the fox's basic deceptive plan by the same actions (utterance) he uses to pose as one deceived by the fox's plan. Thus, the rooster is practicing deception on the fox, just as the fox attempts to on the rooster, but he also practices a double deception in that he leads the fox to believe that the rooster has been deceived.

Structure in Terms of Belief Spaces

Consideration of the plans of the characters in even the simple story of the fox and the rooster shows that plans cannot be viewed solely as tree or graph diagrams relating acts, states, intentions, and so on. Instead, they must be seen as belief structures that relate to other belief structures. In every story, a character's plan has to be considered as part of that character's beliefs, or part of another character's beliefs

about the first character's beliefs, or part of some other belief space. In fact, we can understand much of a story's structure by the belief space organization without referring to the detailed structure (of acts and states) that is usually considered to be the analysis of a plan.

Let us return to look at Figure 1 for part of the belief space organization of "The Fox and the Rooster." The diagram represents what we assume that the rooster believes (RB). A similar, but simpler, diagram would be needed for the fox (FB). The innermost part of the diagram, labelled "coinciding mutual belief" contains beliefs shared by the rooster and the fox and known by each to be shared. This includes the part of the breakfast episode that is not virtual, for example, the mutual awareness that particular utterance acts have occurred. If there were no deception in the story, then this would be the complete belief space organization. The two boxes, labeled "fox's pretended plan" and "rooster's pretended plan," hold those parts of the breakfast episode that are virtual, e.g., that the fox intends to serve breakfast to the rooster, or that the rooster intends to leave the tree. Notice that if this were a diagram of the fox's beliefs, we would not have a "rooster's pretended plan."

To the left of "coinciding mutual belief" is the fox's real plan, as it is known to the rooster. The rooster might reason

as follows: Because the fox thinks he is succeeding in his deception, his real plan is in his direct beliefs (FB) but not in what he believes the rooster believes about him (FBRBFB). Because the fox's deception fails, these beliefs are in fact in RBFB, i.e., the rooster knows the plan, and since the rooster thinks the fox thinks he has fooled the rooster, the plan is not in RBFBRBFB, i.e., the rooster believes that the fox believes that the rooster does not know the fox's real plan. To the right is the rooster's real plan, the double deception. Since his plan works, these beliefs are only in RB (and not in FBRB).

In order to understand this story, a reader has to keep track of the (changing) belief space organization, marking beliefs as held by rooster, fox, dog, or reader. Since a belief can be about a belief, the reader also has to place each belief in appropriate embedded spaces, say, the rooster's beliefs about the fox's beliefs about the rooster's beliefs (RBFBRB). Such ongoing auditing of beliefs is more than just an interesting game that occurs during reading; in many cases it is the very foundation for understanding the essence of the story.

Author-Reader-Character

Things are never as simple as they seem. We have been discussing "The Fox and the Rooster" as if there were only one possible interpretation -- as if all readers reach the same

conclusions and as if the author were simply reporting the "facts" about an event. There are, in fact, no "facts" in a story. Instead, we have sentences produced by an author that are used by a particular reader to manufacture a model of events, a model that includes models presumably manufactured by the characters. The reader also must consider that the story is a directed set of events; the author is actively choosing what to say and when to say it. Thus we need to consider the belief spaces of the implied author and of the implied reader as well as those of the characters.

One consequence of the expanded view which includes implied author and implied reader is that different interpretations of the same story can be more easily compared. For example, in "The Fox and the Rooster," many people (especially, but not exclusively, very young ones) arrive at a radically different interpretation from the one presented above. They see the rooster as the fool who survives through chance. As one ten year old said, "Roosters are dumb animals! They have pointed heads." It is as if she could imagine the rooster chiding the dog, "You shouldn't have bitten nice Mr. Fox. He was inviting us to breakfast."

In terms of our interacting plans analyses the choice between the two interpretations of the story appears to hinge on a single belief. This <u>critical belief</u> is that the reader

believes that the rooster believes that foxes like to eat roosters and that the rooster uses this belief in concocting his plan. Without the critical belief, one could easily arrive at the "dumb rooster" theory about the story, a theory which leads to major differences in the perceived story (although not in the tree structure that would come from a story grammar analysis). The diagram of the rooster's beliefs under the dumb rooster interpretation is not the complex structure shown in Figure 1, but simply the structure of coinciding mutual belief.

Differences among readers in their critical beliefs may arise from differing literary experiences or from general cultural differences. We found in protocol analyses of children reading "The Fox and the Rooster" that their experience with fables about foxes affected the way they interpreted the story. This merely corroborates some more general findings about cross-cultural differences in text comprehension (Bartlett, 1932; Steffensen, Jogdeo, & Anderson, 1978; Kintsch & Greene, 1978).

Limitations

The notation system presented here has some inherent limitations. For one, while it is straightforward to represent elaborate interactions between any two characters, it is not easy to represent three-way (or greater) way interactions

clearly. Another limitation involves changes in beliefs as the story proceeds. In many cases, one can either assume that important beliefs do not change during the course of the story, or else pick a point in the story, say, just before a climax, and analyze the story at that point. Otherwise, a set of belief space representations is needed, one for each point in time. This can become quite cumbersome. Also, the representations show the full result of planning, but only a sketch of the process of planning. For a single character plan a representation of the steps of planning is neither serious nor problematical. For social plans, however, we need to have a better way of capturing the dynamics involved in the creation and maintenance of a social reality.

Another point to remember is that a single interacting plans diagram represents only one interpretation of a story. To compare alternative interpretations, we need separate complete diagrams, and, of course, we can never be sure that a different critical belief would not lead to yet another interpretation. Also, some stories may achieve their effect by deliberate ambiguity in the interactions among the characters.

A final caution concerns the relationship of an interacting plans analysis to literary analysis in general. While the approach outlined in this paper contributes to an understanding of structural and plot-like aspects of a story, it has little to

say about numerous other aspects, such as theme, allegory, rhythm, irony, character development, and the like. A limitation of this sort is important to keep in mind as a restriction on any analysis of structure or character's plans. One can hope, however, that by making explicit the belief-embedded nature of plans that we may more easily link a structural analysis to other accounts of a story.

Conclusion

This paper presents a way to analyze stories that is concerned with (1) the structures that relate actions, utterances, and thoughts of characters, (2) the plans of characters that may be inferred from their actions, and (3) the social and subjective aspects of those plans. By emphasizing the roles of beliefs and interactions among plans, this approach gives a richer and more direct account of story structure than one could obtain by either a purely structural account or a consideration of simple plans.

One might well ask whether the interacting plans approach is then a way to study stories or a way to study story understanding. I would argue that with respect to interacting plans such a distinction is at best tenuous. The processes that a story analyzer needs to engage in happen to be a subset of those that any reader needs to do. Any reader needs to build a

model of the plans of characters as they exist in the belief spaces of the characters. This model building may not be conscious, or as explicit as we have made it here, but in order to say, "The rooster fooled the fox," the reader must construct a rich model of the fox's and the rooster's beliefs about each others' plans and beliefs. Interacting plans analysis is therefore the reader's guide, as well as ours, to understanding the structure of a story.

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